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Apocalypses Now: Modern Science and Biblical Miracles. The Boyle Lecture 2018

Abstract

I explore an intriguing area that has crept under the radar of today's science-and-theology conversation, namely scientific studies of the big miracle and catastrophe stories of the Bible (e.g. Noah's flood, or the plagues of Egypt). These studies have proposed naturalistic explanations for some of the most spectacular and unlikely of the biblical miracles. While the scientists believe their naturalistic interpretations represent a major advance in understanding the stories, professional biblical scholars show little interest, or are openly disdainful. I will point out the striking parallels with the foundational 'catastrophism-uniformitarianism' controversy in nineteenth-century geology, and will suggest that the debate also takes us towards a novel kind of natural theology when we consider the biblical miracle and catastrophe texts. Here, the spectacular scientific explanations do not deny the miraculous character of the biblical stories so much as provide a uniquely modern purchase on their transcendent quality.

Keywords: Miracle, catastrophe, Exodus, apocalypse, naturalistic explanation, biblical studies, uniformitarianism, catastrophism, hermeneutics

Introduction

The Boyle Lectures were established in 1692, upon the death of the celebrated eighteenth-century natural philosopher, theologian and chemist, Robert Boyle (1627-1691). The original purpose of the lectures was to defend Christian theology against unbelief; however, in practice the lectures have become known for their explorations of

the relationship between Christian theology and the natural sciences. This present article gives a slightly-expanded version of the 2018 Boyle Lecture delivered in St Mary-le-Bow Church, London on 7th February 2018.

You may have spotted that my title, ‘Apocalypses Now’, is a pun on *Apocalypse Now*, Francis Ford Coppola’s famous film of the Vietnam War. But you may be wondering what the joke is, since the film is a far cry from science and theology. The film is a re-telling of Joseph Conrad’s novel, *Heart of Darkness*. Both *Apocalypse Now* and *Heart of Darkness* explore the culture clash between the technologically-advanced West and a supposedly-primitive culture, raising questions about imperialism and the ‘heart of darkness’ in our modern world. For those of you familiar with the culture wars of recent years, and especially with the supposed conflict between science and religion, talk of imperialism raises the spectre of scientism, of the assumption that the natural sciences provide the most authentic route to knowledge, and that religion provides little better than primitive superstition in comparison. I don’t want to wade into the debate around scientism, since previous Boyle lecturers have covered that (Alister McGrath notably, in the 2014 Boyle Lecture), but instead to introduce several un-expected reversals which have gone under the radar, as it were, of the standard science-and-theology conversation. These reversals concern the big miracle and catastrophe stories at the heart of the Bible, where divine providence is revealed in nature: apocalypses from the ancient world. I’ll introduce these stories, and will explain how modern science, far from dismissing them as fantastic and primitive fairy tales, instead gives us new ways of hearing these ancient stories of revelation, new re-tellings if you like: apocalypses now.

Let me say a little more by way of an extended introduction. It’s usually assumed that science and miracles are incompatible, harking back to David Hume’s (1711-1776) famous definition

of miracle in endnote [K] to his ‘Of Miracles’ section of *An Enquiry concerning Human Understanding* (Hume [1777] 2007, 127). Here, a miracle is an event caused by God (or another invisible agent) that violates or transgresses a law of nature. Hume’s definition effectively provides a universal yardstick for defining the natural against the supernatural, and a miracle against a natural event: we can usually all agree on what constitutes a law of nature, his reasoning goes, so a miracle would need to be a violation of one of those universally-agreed laws. Hume’s definition has survived remarkably well since the 1700s, since it’s virtually ubiquitous in our modern world. But there are also various problems with it, and the problem I want to focus upon is the fact that many of the Bible’s miracle stories can be explained scientifically (i.e. by means of the laws of nature), *and yet great numbers of people still believe they’re miracles*, on account of the fact that God’s providential purposes are seen to be fulfilled. Hence, we find that, once we look at individual case studies, science and miracles can be compatible after all. (You might ask why Hume’s definition is ubiquitous if it’s problematic. I don’t have the scope to explore this here; but I will simply suggest that the success of Hume’s definition is related more to the way it supports the modern secular agenda of naturalism than its ability to capture the definition of a miracle accurately).

The contemporary science-and-theology scene has long been fascinated by the Bible’s first few chapters, the Genesis creation stories (Gen.1-3). Clearly, that’s at least partly because the culture wars are so fixated with creation versus evolution. I’ve played my own part in this area (Harris 2013; 2018; De Pomerai and Harris 2017), but I’m more intrigued by the rest of the Bible, particularly the many stories that tell how the biblical God redeems his people, sometimes punishes them, sometimes reveals his purposes to them, often in spectacular and terrifying ways through the natural world. Prime examples are found in the Book of Exodus, such as the story of God’s revelation to Moses in the Burning Bush (Ex.3), or the Plagues of

Egypt (Ex.7-12) or the Crossing of the Red Sea (Ex.14-15). These biblical stories where nature runs riot to deliver divine purposes aren't so much supernatural as *hypernatural* (i.e. 'nature in excess'; Fretheim 2005, 119-120): nature itself becomes transcendent in order to mediate and reveal the divine. This motif appears again and again in biblical texts, obviously in the psalms and prophets,ⁱ but in many other places too, including the classic apocalypses (e.g. the Apocalypse of the Clouds, 2 Baruch 53), of which the definitive case stands at the very end of the Bible, the Book of Revelation.

What has particularly intrigued me about these hypernatural texts is that I'm by no means the only scientist to be intrigued by them. In fact, there exists quite a substantial body of scientific writing that proposes naturalistic and scientific explanations for these bizarre and spectacular stories, working on the assumption that the biblical text presents accurate observations of things that actually happened in history. The biblical stories become scientific data, if you like, descriptions of freak events and natural disasters that can be modelled scientifically.

This scientific interest in the Bible's stories of miracle and hypernature isn't new. Some notable scientists of the seventeenth and eighteenth centuries took an interest in applying their naturalistic wisdom to the Bible's miracle stories, including Boyle lecturers such as Samuel Clarke and William Whiston (Harrison 1995, 542-544). In fact, there's a story to be told about the positive influence of these biblical texts on the historical development of science. The story of Noah's Flood (Gen.6-9), for one, was highly significant in shaping early scientific thinking on the earth (Cohn 1996). Whiston, for instance, proposed that the Flood was caused by a comet encountering the earth, which precipitated apocalyptic falls of rain, and a vast tide that covered the planet (Whiston 1737, 461-478). Of course, the science has

moved on since Whiston's day, although the fascination of many modern scientists with the flood story remains (e.g. Huggett 1989; Kristan-Tollmann and Tollmann 1994; Deutsch *et al.* 1994; Baillie 1999; Masse 2007; Montgomery 2012). And what's remarkable is that contemporary studies of biblical miracles and catastrophes – bringing to bear the much-advanced rigour of today's sciences – have been able to find naturalistic explanations for even the most spectacular and unlikely of the biblical stories. I'll give you some examples shortly. But my point is that there's almost nothing in the Bible that the modern sciences can't explain if sufficient ingenuity is brought to bear. This flies in the face of our usual understanding of a miracle as an 'impossible' event in natural terms, since these studies show that the seemingly impossible biblical stories are quite 'possible' in naturalistic terms, if unlikely. The incredible happens, but no laws of nature are violated. So what's going on? Do these studies *disprove* the miraculous nature of the stories by finding scientific explanations? Or do they *affirm* it? A clue to what's at stake here is a surprising disagreement between the relevant experts. While the scientists believe their naturalistic explanations represent a major advance in understanding the stories, professional biblical scholars show little interest, or are openly disdainful, claiming that these scientific explanations are implausible and that the scientists misunderstand the texts. Well it turns out that this contemporary disagreement has a precedent, back in nineteenth century geology, when what was then a fairly new science was setting out its methodological stall. I'll point out the striking parallels here between how the various experts – scientists and biblical scholars – interpret the scriptural witness on the one hand, and how geologists interpret the witness of the rocks on the other. In both cases – Bible and geology – we're faced with the question of how to interpret evidence from the past when there are competing explanations. In other words, this dispute about the Bible equally concerns how you do science. I'll close by suggesting that the dispute also points us towards

a rather-overlooked kind of natural theology, which exposes the transcendent quality of the Bible's stories. Here, we find that the scientific interpretations are 'apocalypses now'.

Naturalistic explanations for the Parting of the Red Sea

With that extended introduction in mind, let me take you through some case studies. My favourite among these biblical apocalypses is the Parting of the Red Sea (Harris 2007), where Moses leads the children of Israel, desperate to escape from slavery in Egypt, across the sea.ⁱⁱ Moses stretches out his hand over the sea, and it divides (Ex.14:21), forming a wall to the right and to the left (vv.22, 29). Moses and the people cross, but when Pharaoh follows, the sea crashes in on the Egyptians, drowning every one (v.28). Easily the most spectacular and incredible miracle story in the Bible, film makers have had a field day with the special effects, from Cecil B. DeMille's first version of *The Ten Commandments* in 1923, up to Ridley Scott's *Exodus: Gods and Kings* of 2014.ⁱⁱⁱ I'm sure you've seen the visuals, of towering walls of water held magically apart while the Israelites scurry over the dry seabed like ants in comparison. Scientists have also had a field day with this story, and in spite of its seemingly-impossible nature, there have been many scientific proposals which claim to explain the miracle in natural, if unusual, terms. Two approaches tend to dominate.

The first suggests that the sea was a lagoon, or a shallow inlet on the coast which parted because of an enormous tsunami from a distant volcanic eruption. The obvious candidate is the eruption of Thera – the volcanic island we now call Santorini in the Aegean Sea – which is why I tend to refer to the various models that fall into this approach as the 'Thera theories' (Harris 2015). Thera was devastated by one of the largest eruptions in human history, probably in the late 1600s BCE, and the eruption apparently caused large tsunamis, and

spread volcanic ash far and wide across the Eastern Mediterranean. Let's picture the scenario. Transport yourself to Egypt, where the Israelites are enslaved. The eruption is hundreds of miles away, but it creates atmospheric storms, earthquakes, and ash falls across the Eastern Mediterranean, including Egypt in this scenario. The first nine plagues of Egypt – where water is turned into blood, then a plague of frogs appears, followed by lice, swarms of flies, a devastating sickness of cattle, boils, hail, locusts, and darkness for three days – all of these can be explained as consequences of the unfolding eruption, far away. The plagues are what allow the Israelites to escape. By the time of the final, most explosive, stage of the eruption, where the island literally blows itself apart, the Israelites have escaped to the Mediterranean coast, and are standing on the shore of a lagoon.^{iv} The volcano's enormous magma chamber, now empty, fills with seawater, which causes the sea to ebb away, and then creates a giant tsunami. First the lagoon empties, and Moses crosses, with the Egyptians in hot pursuit. But just as the Israelites reach higher ground, the tsunami appears, and the Egyptians are swept away.^v

Such is a typical scenario for reconstructing the sea crossing using the eruption of Thera, and you can find it developed in many scientific articles, books, and TV documentaries over the last few decades. I'm a sceptic myself though. I worry about the lack of material evidence that the eruption of Thera actually had any impact on Egypt, and there's also a notorious problem about timescales, since the eruption of Thera took place centuries before the usual scholarly timeframe for the historical setting of the exodus in the 1200s BCE.^{vi} Remarkably though, problems like this don't seem to stop the Thera theories: they keep being proposed as the ideal solution, not only for the exodus, but for other outstanding mysteries of the second millennium BCE, especially the end of Minoan civilisation on Crete, and the legend of

Atlantis. This tells us something about the imaginative appeal of the Thera theories, as ‘apocalypses now’. I’ll come back to that.

Let’s move on to the second naturalistic approach to the parting of the Sea. This one makes use of tremendous winds to push the sea aside, and it has the advantage over the tsunami explanation of being exactly what the biblical text specifies: ‘Then Moses stretched out his hand over the sea. The Lord drove the sea back by a strong east wind all night, and turned the sea into dry land; and the waters were divided’ (Ex.14:21). There’s a further advantage: the wind explanation works for pretty much any body of water you think might be the one that Moses crossed, whether it’s one of the shallow inland ‘seas’ in the Isthmus of Suez (e.g. Drews and Han 2010), or the deep Red Sea. As you might expect, the most spectacular location is the Red Sea itself, and models have been proposed where a storm-force wind is funnelled down the Gulf of Suez (Nof and Paldor 1992; 1994) or the Gulf of Aqaba (Humphreys 2003). Here, the topography of land and seabed is such that violent winds blowing in the right direction for the right length of time can have a substantial effect on the sea level. One calculation, for instance, suggests that the sea in the Gulf of Suez could recede from the shore by nearly a mile under such conditions, exposing a large portion of seabed, such is the unusual topography hereabouts (Nof and Paldor 1992; 1994). When the wind dies down, the sea returns. Moses and the Israelites are standing on the edge of the Red Sea when the storm arrives, and they’re able to cross over during the night while the wind blows. In the morning when the wind subsides, the sea returns and destroys the pursuing Egyptians.

It’s important to point out that this kind of storm wind is by no means an everyday event. The same model predicts that the conditions are right only every 1000 to 3000 years. So it’s certainly not a miracle in the sense of any laws of nature being broken; more in the sense of

being such an unusual happening on a human timescale that it's not going to be remembered from one occurrence to the next (Nof and Paldor 1994, 1023-4). In human terms then, a storm which exposes the seabed to such a degree is un-precedented, unique, and if you're at the right place at the right time, providential. Clearly, then, in this model, if there's a miracle to speak of, it's that Moses and the Israelites happened to be in the right place at the right time.

One scientist who makes a great deal of currency out of this point is the Cambridge materials scientist Colin Humphreys, who has written a book-length treatment of the miracles of Exodus (Humphreys 2003), claiming that they can all be explained by naturalistic models such as this. He doesn't want to explain the miracles away – far from it – but rather to strengthen belief in the miracles. It isn't the nature of an event that makes it miraculous, he thinks, since a naturalistic explanation can be found for most claimed miracles; rather, the miracle is in the timing. Humphreys explains this by looking at the end of the exodus story (Josh.3), where Joshua and the Israelites have wandered in the wilderness for forty years, and are finally ready to cross into the Promised Land. Only one barrier stands in their way, the River Jordan. Miraculously, it stops flowing to allow them to cross. Humphreys points out that the Jordan is, in fact, well known to stop flowing for short periods when an earthquake dislodges the river banks further upstream. This means that the miracle is in the timing: Joshua and the Israelites were standing on the banks of the Jordan at just the right time after an earthquake. For Humphreys, the fact that a naturalistic explanation is so readily at hand for this biblical story means that the miracle is more believable, not less (Humphreys 2005, 5).

Now Humphreys isn't doing anything new here. Go back to the eighteenth century Boyle lecturers I mentioned earlier, Samuel Clarke and William Whiston. This was exactly their point about biblical miracles. If science can confirm that the miracles are plausible natural

events, then that supports the authenticity of the Bible as a credible record of God's dealings with the world (Harrison 1995, 543-544). There is an apologetic argument, using science to *uphold* the biblical witness, not to *downgrade* the miracles to mere unusual events. The miracle is in the timing: God led Moses, Joshua and the Israelites to the right place at the right time. To a sceptic, this might be coincidence; to a believer, it's providence. No laws of nature are violated, but still God's providential purposes are achieved miraculously, and science provides confirmation, according to this view.

Here we see the first unexpected reversal in the relationship between science and theology that I mentioned earlier. Science and theology are *not* in conflict in this view; rather, science is serving theology. Hence, scientific studies of the Bible, far from disproving it as an ancient record of primitive superstition can, if you're so disposed, be taken as evidence of the credibility of the Bible, and of its witness to divine providence. The important assumption here is that the Bible 'tells it like it really happened'. But does it? Here we need to turn to the biblical scholars: the professional historians, archaeologists and linguists who bring a very different set of skills to the scientists. What do they think of this scientific work on the Bible's apocalypses?

Biblical scholarship on the Parting of the Red Sea

Not a lot, it seems. If you plough through the heavy scholarly commentaries, or scour the research literature on Exodus, you'll be hard-pressed to find this scientific work even being mentioned. When it is, the assessment is usually dismissive. To give you a flavour, here are three colourful statements from biblical scholars (and they are almost the only explicit

statements that I've been able to find; the silence is deafening). First is Maxwell and Hayes (1986, 65), from their classic textbook, *A History of Ancient Israel and Judah*:

Theories of this sort attempt to give naturalistic and scientifically acceptable explanations for the more fantastic and miraculous biblical claims. In our opinion, however, these theories presuppose such hypothetical scenarios, such a catastrophic view of history, and such marvelous correlations of coincidental factors that they create more credibility problems of their own than the ones they are intended to solve.

The Thera theories, and other naturalistic 'theories of this sort', they say, are simply implausible. (And note that this is quite an accusation when we're dealing with an incredible miracle story to begin with. More on plausibility issues later). The second assessment of scientific models from a biblical scholar is from Bill Propp's (1999, 347-348) magisterial commentary on Exodus:

Any rigorous attempt to explain the whole Plagues narrative as a naive but basically accurate report of a chain of natural calamities is doomed from the start. Rationalistic explanations for miracles...are anachronistic today. To believe that the Bible faithfully records a concatenation of improbable events, as interpreted by a prescientific society, demands a perverse fundamentalism that blindly accepts the antiquity and accuracy of biblical tradition while denying its theory of supernatural intervention.

So Propp is also worried about plausibility, but he adds more. Notice his phrase, 'perverse fundamentalism'. His concern is that the scientific models treat the text at face value, ignoring the fact that the text arose in a world very different from our own. The scientists

read the Bible like a *fundamentalist* would, Propp thinks: literally, under the assumption that it reports straightforward eyewitness testimony, as it happened. And the scientists also read it *perversely*, Propp tells us, not recognising the theological presuppositions underlying the text, presuppositions that a true fundamentalist would recognise immediately.

There's also a concern about professional rivalry. Look at this final assessment from a biblical scholar, this time William Johnstone (2005, 378) writing on Colin Humphreys' scientific explanations of Exodus miracles:

Humphreys' predominant ignoring of scholarly tradition is matched by a breath-taking self-belief and self-reliance on his own personal experience.

This provides us with one final reason why biblical scholars are sceptical of scientific explanations of the Bible's miracles: professionalisation. The scientists are so caught up in their own professional bubbles, seems to be Johnstone's point, that they overlook the highly-specialised theological, historical and linguistic problems raised by the text, problems that take years of painstaking training to master; a scientific training simply doesn't provide the correct expertise.

Let me sum up so far. The scientists and biblical scholars couldn't be more different. If the scientists assume that the biblical text provides data about amazing events from ancient times, the biblical scholars insist that we can't even begin to say 'what really happened' back then before taking full account of the text we possess now. The stories certainly weren't recorded at the time, maintains critical biblical scholarship, but they circulated in oral form for centuries before being written down, slowly gathered together, and edited into what we now

call the Book of Exodus, which, in any case, comes to us from copies of copies produced centuries later still. There's plentiful evidence that in all that time, rich and creative theological thinking was being applied to make sense of what was being told, thinking that made its way into the stories themselves as they were told and re-told, recorded and re-recorded. The text of the Parting of the Sea, for instance, is highly composite: it seems to consist of perhaps four slightly different traditions that have been woven together, traditions that differ in the details of what they describe, but you'd hardly notice it on a surface-level reading (Noth 1962, 102-120; Childs 1974, 215-230; Propp 1999, 476-485). More importantly, there are signs that the story has been heavily-influenced by a creation myth that was widespread in the Ancient Near East, where the creator deity battles with the sea personified as a dragon, and divides her in two, thus forming heavens and earth (Snaith 1965, 395-398; Eakin 1967, 378-384; Batto 1983, 27-35; Dozeman 2009, 304). The Parting of the Sea in Exodus, then, might look to us moderns like an incredible miracle in time and space, but in the thought-world of the Ancient Near East it also echoes a creation story telling of figurative new beginnings on a cosmic scale. I could go on, but the point is that if you want to discern what really happened back then, the text we have now is the starting point of your journey, not the end. You need to carefully sift through layers and layers of mythological, theological, and cultural interpretation *which are built into the very story itself* before you get to the supposed historical kernel, if it's indeed there in the first place.

In other words, we have a fundamental disagreement between two kinds of expert over the same basic evidence. The scientists believe they can find naturalistic models to explain what the text says happened to Moses; the biblical scholars insist that the everyday human phenomena of story-telling, reflection, explanation, and re-telling of the story, over and over again, account for much of what we find in the text before we bring scientific models to bear.

You may be suspecting by now that my sympathies lie with the biblical scholars. And so they do. I've spent much of my life in science, but I've also spent a number of years working in biblical studies, and I'm firmly convinced that there's more to the matter of determining what really happened in miracle stories than finding an appropriate scientific model. However, my point here isn't to take sides, but to explain how this divide between scientists and biblical scholars – between science and theology, if you like – leads us to the second unexpected reversal between science and theology. For we now see that the scientists are the believers in the integrity and literal reliability of the Bible, while the biblical scholars (the theologians) are the sceptics. The tables are turned. Science has become faith; theology has become disbelief.

The Uniformitarianism-Catastrophism Debate

How did this divide between scientists and biblical scholars arise, and what does it mean for the culture wars between science and religion? Is it mere professional rivalry, or is there something deeper at stake? I suggest that there's something very deep at stake here, and to see it we need to go back to the 1830s, to a controversy known as the 'uniformitarianism-catastrophism debate', over how the then relatively new science of geology should interpret the evidence of the past.

For the most part, doing geology is very different to the typical laboratory work that goes on in much of physics and chemistry, where experiments can be repeated again and again in real time, where key parameters can be isolated and varied at will, and where spurious effects can be controlled by adapting the environment (Cleland 2002). Geologists can do little of this:

they simply can't replicate in the laboratory the enormous spatial and temporal effects they're interested in; instead, much of their work needs to be carried out in the field, interpreting the fragmentary, scrambled and highly context-dependent evidence that's available of the earth's past. Does this sound familiar? It is, of course, an analogous problem to interpreting an ancient text like the Bible: dealing with the fixed, fragmentary, and perhaps scrambled evidence that has come down to us from a long-vanished culture, with all its potential messiness and historical contextuality. In each case – whether we are mining an ancient text or reading the earth's rocks – our evidence of the past is limited and partial compared with that of our present. Interpreting the historical evidence requires an essentially *hermeneutical* decision to be taken about how we should in principle read the past in light of the present.

The debate between uniformitarianist and catastrophist viewpoints in nineteenth-century geology concerns exactly this hermeneutical question of how to reconstruct the past given limited evidence. There's a 'popular mythology' (Hallam 1983, 29) of the debate which has been revised significantly in recent years by historians of science (e.g. Rudwick 2008), but which nevertheless captures the important hermeneutical issues at stake. Put simply, the school of thought that we've come to call catastrophism assumes that, from time-to-time in the earth's past, the geology was shaped by sudden and dramatic cataclysms ('apocalypses' in effect), the likes of which we simply don't see today. Noah's Flood was often taken as probably the most recent such cataclysm: worldwide and devastating in extent. And mountain chains like the Andes, for instance, were assumed to have been thrown up suddenly, perhaps in a matter of minutes, hours or days, by immense, planet-shattering earthquakes (Élie de Beaumont 1830). The opposing school of thought, uniformitarianism, insists that the rocks should be interpreted in completely the opposite direction, reading them largely in terms of gradual, imperceptible changes over vast time periods. Unless there's strong evidence to the

contrary, goes this way of thinking, we should assume that the geological processes of the past are uniform with the processes we see today (which are often very gentle, if not imperceptible on a human timescale), hence the name uniformitarianism. But time is the key. Given enough time even the jagged immensities of the Andes can be explained by uniformity, as the mountains inch their way skywards, infinitesimally slowly on a human scale, but no less certainly for that.

The argument was eventually seen to be won in favour of uniformitarianism, which has dominated geology ever since, or at least until the late twentieth century. In the 1970s interest in rare and violent events in earth history began to prompt a re-assessment (and certain rehabilitation) of catastrophist ways of thinking (Ager [1973] 1993). The key turning point came in 1980, when a new theory was published in the high-impact journal *Science* proposing that the mass extinction at the end of the Cretaceous period (which included the demise of the dinosaurs) was driven by a large asteroid impact (Alvarez *et al.* 1980). Debated intensely through the 1980s, this proposal, which invokes a catastrophe on a truly global scale, is by now largely mainstream; more importantly, its success has spurred the development of other ‘catastrophist’ models of episodic and rare events in earth history, especially for mass extinctions (Hallam 2004). In short, the pendulum in geological thinking has swung back some way towards catastrophism, to the extent that the earth sciences today can be said to exist in a happier medium between the two schools of thought, between uniformitarianism and catastrophism.

My point in rehearsing this debate, albeit briefly, is to shed light on the divide between scientists and biblical scholars over how we interpret the Bible’s stories of miracles and hypernature. There are clear parallels here between the rocks and the Bible over how to *read*

limited evidence in order to reconstruct history. Should we interpret the evidence in terms of one-off dramatic events (as catastrophism would have it)? Or will the evidence succumb to a more complex, mundane and gradualist view (that of uniformitarianism)? All things being equal, which should be the preferred approach, or is there a middle way?

Take the sea crossing again. Is it best analysed by a naturalistic model that takes the text at face value and explains the incredible events it describes by means of a nearly-as-incredible volcanic eruption and a series of amazing one-off coincidences where Moses just happens to be in the right place at the right time? Or should the narrative be seen in terms of an evolutionary process, where a much more mundane original story slowly accrues layers and layers of theological and mythological interpretation through the telling and re-telling over generations, until it becomes the spectacular tradition we possess? While the first corresponds to the ‘catastrophist’ approach favoured by many natural scientists who write on the biblical stories, the second is the ‘uniformitarian’ view, defended by the majority of biblical scholars.

I am suggesting that the divide between scientists and biblical scholars over how to read the Bible’s apocalypses is parallel to the long-running debate on how to do an historical science like geology. In each debate, there are two schools of thought, both working with the same evidence, but applying radically-different methodologies to reconstruct the past, one emphasising the remarkable, and the other emphasising the mundane. Consequently, the two schools arrive at radically-different conclusions about that past. Which one is right? Either? Both? Neither?

The fact that geological science has itself shifted ground on this dilemma over the last two centuries suggests that there’s no easy answer, although if we’re to take contemporary

geology as our guide, then a creative synthesis of the two opposing camps – of catastrophism and uniformitarianism – would seem to be our best bet when looking at the Bible. Hence, learning from the parallel in geology, which has evolved over nearly two centuries towards a compromise, I suggest that future work on the Bible's stories of miracle and catastrophe should find a way to incorporate both 'uniformitarian' (biblical scholarship) and 'catastrophist' (naturalistic) approaches. In my concluding argument I go on to suggest that the broad category of natural theology might provide a suitable means of building a creative synthesis in this area.

Natural theology

Let's return to plausibility issues. Remember that I quoted several biblical scholars who were, frankly, incredulous of the scientific models, wondering how anyone would take these unlikely naturalistic scenarios and amazing coincidences seriously. The irony won't have escaped you that the Bible's stories of miracle and hypernature themselves are unlikely and amazing. Have the biblical scholars missed the irony here? No. For them, the story we have is so far removed from whatever might really have happened, that there's little to be gained by modelling it in literalistic and naturalistic terms. If there ever was *one* original story of the Parting of the Sea, we're incapable of discerning it at this remove, goes their argument, because the story has slowly shifted like the sands, and has gathered accretions and layers of truth over generations. The biblical scholars have probability on their side. All other things being equal, a catastrophist interpretation – where a one-off unlikely event explains the evidence – is inherently unlikely compared to a uniformitarian interpretation, which works with an evolutionary, everyday explanation. The probability of the remarkable naturalistic event is low by its very nature; the probability of the human processes of myth-making and

story-telling are virtually certain by comparison. This point alone explains much of the disinterest that biblical scholars show towards naturalistic explanations.

So when looked at as a human document, I'm with the biblical scholars. The scientific models of the Bible's miracles and apocalypses are frankly implausible. But speaking more charitably, there's a sense in which the scientific models can be seen as a form of 'myth making' in their own right (Berger 2007, 271), an observation which provides a hint towards the theological way forward that I want to suggest.

As a Christian and a theologian, the Bible is also, for me, a record of God's dealings with the world, and this is where the scientific models have a place, I believe. This leads to our third and final reversal between science and theology. I think it's unlikely that the scientific models can tell us much about 'what really happened': they're not much use from the perspective of doing history with the text. From the perspective of doing theology though, especially *natural* theology, the scientific models are invaluable, I suggest. Remember that I've been emphasising these biblical stories as apocalypses, as moments of revelation. In spite of their speculative and fantastic nature, I suggest that the scientific models offer a uniquely modern purchase on the transcendent quality of these stories. The models shine a contemporary spotlight on these stories' ability to reveal the remarkable in the mundane, the hypernatural token of God's interaction with the world. The fact that there are often multiple scientific models competing with each other over how best to explain one miracle story is a bonus, not a problem to be resolved. The scientific models are, to me, creative and imaginative re-tellings of the biblical stories in the language of our own scientific world, highlighting for us the remarkable and stupendous character of God's relationship with nature.

So my final message is: let's have more of these scientific models, not fewer. Let the scientists be more imaginative, and the biblical scholars more hard-headed and rational. Let science be more theological, and biblical studies more scientific. Because it's at the level of natural theology that I suggest we should understand these scientific models, as theological animations and re-animations of the evidence before us, the text of the Bible. The models are 'apocalypses now'.

REFERENCES

Ager, Derek V. [1973] 1993. *The Nature of the Stratigraphical Record*. Chichester, New York, Brisbane, Toronto, Singapore: John Wiley & Sons.

Alvarez, Luis W., Walter Alvarez, Frank Asaro and Helen V. Michel. 1980. "Extraterrestrial Cause for the Cretaceous-Tertiary Extinction." *Science* 208: 1095-1108.

Baillie, Mike. 1999. *Exodus to Arthur: Catastrophic Encounters with Comets*. London: Batsford.

Batto, Bernard F. 1983. "The Reed Sea: Requiescat in Pace." *Journal of Biblical Literature* 102:27-35.

Berger, W. H. 2007. "On the discovery of the ice age: science and myth." *Geological Society, London, Special Publications* 273:271-278.

Childs, Brevard S. 1974. *The Book of Exodus: A Critical, Theological Commentary*.

Louisville: Westminster Press.

Cleland, Carol E. 2002. "Methodological and Epistemic Differences between Historical Science and Experimental Science." *Philosophy of Science* 69:474-496.

Cohn, Norman. 1996. *Noah's Flood: The Genesis Story in Western Thought*. New Haven: Yale University Press.

De Pomerai, David, and Mark Harris. 2017. "Creationism and Evolutionary Biology: Science or Pseudo-Science?" In *Philosophy, Science and Religion for Everyone*, ed. Mark Harris and Duncan Pritchard, 27-39. Abingdon, New York: Routledge.

Deutsch, Alexander, Christian Koeberl, Joel D. Blum, Bevan M. French, Billy P. Glass, Richard Grieve, Peter Horn, Elmar K. Jessberger, Gero Kurat, Wolf Uwe Reimold, Jan Smit, Dieter Stöffler, and Stuart Ross Taylor. 1994. "The Impact-Flood Connection: Does It Exist?" *Terra Nova* 6:644-650.

Dozeman, Thomas B. 2009. *Commentary on Exodus*. Grand Rapids (MI), Cambridge: Eerdmans.

Drews, Carl, and Weiqing Han. 2010. "Dynamics of Wind Setdown at Suez and the Eastern Nile Delta." *PLoS ONE* 5:e12481.

Eakin, Frank E., Jr. 1967. "The Reed Sea and Baalism." *Journal of Biblical Literature* 86:378-384.

Élie de Beaumont, L. 1830. *Recherches sur Quelques-unes des Révolutions de la Surface du Globe, présentant différens exemples de coïncidence entre le redressement des couches de certains systèmes de montagnes, et les changemens soudains qui ont produit les lignes de démarcation qu'on observe entre certains étages consécutifs des terrains de sédiment*. Paris: Chez Crochard.

Fretheim, Terence E. 2005. *God and World in the Old Testament*. Nashville: Abingdon.

Hallam, A. 1983. *Great geological controversies*. Oxford: Oxford University Press.

Hallam, Tony. 2004. *Catastrophes and lesser calamities: The causes of mass extinctions*. Oxford: Oxford University Press.

Harris, Mark. 2007. "How did Moses part the Red Sea? Science as salvation in the Exodus Tradition." In *Moses in Biblical and Extra-Biblical Traditions*, ed. Axel Graupner and Michael Wolter, 5-31. Berlin, New York: de Gruyter.

Harris, Mark. 2013. *The Nature of Creation: Examining the Bible and Science*. Durham: Acumen.

Harris, Mark. 2015. "The Thera Theories: Science and the Modern Reception History of the Exodus." In *Israel's Exodus in Transdisciplinary Perspective: Text, Archaeology,*

Culture, and Geoscience, ed. Thomas E. Levy, Thomas Schneider, and William H. C. Propp, 91-99. Cham, Heidelberg, New York, Dordrecht, London: Springer.

Harris, Mark. 2018. "The biblical text and the functional interpretation of the *imago Dei*." In *Finding Ourselves after Darwin: Conversations on the Image of God, Original Sin, and the Problem of Evil*, ed. Stanley P. Rosenberg. Baker Academic, in press.

Harrison, Peter. 1995. "Newtonian Science, Miracles, and the Laws of Nature." *Journal of the History of Ideas* 56:531-553.

Huggett, Richard J. 1989. *Cataclysms and Earth History: The Development of Diluvialism*. Oxford: Clarendon.

Hume, David. [1777] 2007. *Enquiry concerning Human Understanding*, ed. Peter Millican. Oxford: Oxford University Press.

Humphreys, Colin J. 2003. *The Miracles of Exodus: A Scientist's Discovery of the Extraordinary Natural Causes of the Biblical Stories*. London, New York: Continuum.

Johnstone, William. 2005. Review of Colin Humphreys, *The Miracles of Exodus*. *Journal of Semitic Studies* 50:373-379.

Kristan-Tollmann E., and A. Tollmann. 1994. "The youngest big impact on Earth deduced from geological and historical evidence." *Terra Nova* 6:209-217.

Masse, Bruce W. 2007. "The Archaeology and Anthropology of Quaternary Period Cosmic Impact." In *Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach*, ed. P. Bobrowsky and H. Rickman, 25-70. Berlin: Springer.

Maxwell, Miller J., and John H. Hayes. 1986. *A History of Ancient Israel and Judah*. London: SCM.

Montgomery, David R. 2012. *The Rocks Don't Lie: A Geologist Investigates Noah's Flood*. New York, London: W. W. Norton and Co.

Nof, Doron, and Nathan Paldor. 1992. "Are There Oceanographic Explanations for the Israelites' Crossing of the Red Sea?" *Bulletin American Meteorological Society* 73:305-314.

Nof, Doron, and Nathan Paldor. 1994. "Statistics of Wind over the Red Sea with Application to the Exodus Question." *Journal of Applied Meteorology* 33:1017-1025.

Noth, Martin . 1962. *Exodus: A Commentary*. London: SCM.

Propp, William H. C. 1999. *Exodus 1-18: A New Translation with Introduction and Commentary*. The Anchor Yale Bible Commentaries. New Haven (CT): Yale University Press.

Rudwick, Martin J. S. 2008. *Worlds Before Adam: The Reconstruction of Geohistory in the Age of Reform*. Chicago, London: University of Chicago Press.

Snaith, N. H. 1965. “יַם־סוּף: The Sea of Reeds: The Red Sea.” *Vetus Testamentum* 15:395-398.

Whiston, William. 1737. *A New Theory of the Earth, From its Original, to the Consummation of all Things*. London: Boyle’s Head.

ⁱ Many examples could be cited here, but the most notable tend to be descriptions either of God’s theophany in natural elements of storm and earthquake (e.g. Judges 5:4-5; Ps.18:7-16; 29; Zech.14), or of creation’s praise of its Creator (e.g. Ps.65:12-13; 98:7-9; Is.55:12).

ⁱⁱ There is a famous debate over the location of the ‘sea’, whether it is indeed the deep Red Sea that we know today, or a ‘Sea of Reeds’ somewhere in the Isthmus of Suez (i.e. a shallow lake or lagoon). This debate is notoriously contorted, and takes in many questions beyond mere translation of the Hebrew terminology. To some degree the two sides of the debate part along plausibility lines for the various naturalistic scenarios presented for the parting of the sea. Note though, that the most detailed description of the miracle occurs in Ex.14, where the body of water is simply called ‘the sea’.

ⁱⁱⁱ A history of attempts to visualise the parting of the sea offers an excellent illustration of how cinematography has evolved over the past 100 years (<https://www.youtube.com/watch?v=T4H5tjx2Zpg>). Accessed 30 April 2018.

^{iv} The Thera theories therefore place the sea crossing at a Sea of Reeds rather than the Red Sea itself, and probably on the Mediterranean coast.

^v The recent film, *Exodus: Gods and Kings* (2014), pictures the sea crossing rather like this, as being enabled by an enormous tsunami.

^{vi} But it’s fair to note that the dating of both the Thera eruption and the exodus are accompanied by a significant degree of controversy themselves. Radiocarbon dates for the eruption of Thera tend to fall around 1620 BCE, while some prominent archaeologists prefer a date closer to 1500 BCE. Dating the events described in the Book of Exodus is even more difficult. Two dates tend to prevail in scholarly accounts, either the so-called ‘traditional’ date of around 1450 BCE, or a Ramesside date in the late 1200s BCE. The latter tends to attract the widest scholarly support, and is the closest to a ‘consensus’. However, note an important subtlety here. While biblical scholars often speak of a Ramesside context to the events described in the Exodus text, a significant proportion of these same scholars are sceptical that these events themselves are ‘historical’ as such. In other words, this latter group is sceptical that we can speak of an historical exodus happening in the form described in the text of Exodus, while this group still recognises that the text evokes a genuine historical context of Ramesside times.